1145

LER Number: 31698004

ACCESSION #: 9906030259

NON-PUBLIC?: N

FACILITY NAME: Cook Nuclear Plant Unit 2
DOCKET NUMBER: 05000316

TITLE: Ice Condenser Bypass Leakage Exceeds Design Basis Limit

EVENT DATE: 04/22/1999 LER #: 1998-004-01 REPORT DATE: 05/24/1999

OTHER FACILITIES INVOLVED: Cook Nuclear Plant Unit 1
DOCKET NO: 05000315

OPERATING MODE: 5 POWER LEVEL: 0%

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:50.73(a)(2)(ii)

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Regulatory Compliance Engineer X1623

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On March 19, 1998, with Unit 2 in Mode 5, coldshutdown, it was determined that the design basis limit of 5 square feet (ft2) for bypass flow around the ice bed during an accident had been exceeded by the cumulative effect of multiple bypass flow paths. This was determined reportable as a degraded condition discovered while the unit is shutdown that, if found while the reactor was operating, would have resulted in the plant being in an unanalyzed condition. An ENS notification was made at 1422 hours

EST. although it was later determined that the design basis limit had, in fact, not been exceeded, Revision 0 of this LER was voluntarily submitted in accordance with 10CFR50.73(a)(2)(ii). The individual bypass conditions identified in the original LER were attributed to unauthorized modifications. Significant bypass flow paths are being corrected as they are discovered.

On April 22, 1999, in Mode 5, during a review of the adequacy of the design and installation of the Divider Barrier Seal (DBS) as a part of the Expanded System Readiness Reviews, it was determined that the seal design and installation at the end walls of the ice condenser does not provide a pressure tight boundary. This newly identified condition increased the cumulative bypass flow area above the design basis limit of 5 ft2. The apparent cause of the DBS ice condenser bypass is that the pressure seal required by a revised Westinghouse design was not incorporated into the AEP design. The reason for this discrepancy is unknown. The DBS ice condenser bypass will be corrected via a design change prior to Mode 4. The new and previously identified conditions have been evaluated and it has been determined that the safety significance of the cumulative bypass flow paths around the ice bed is negligible. If all known conditions had existed simultaneously, and passed flow at their maximum bypass capability, the cumulative effect would have been above the design basis limit of 5 ft2, but below the value assumed in the most limiting accident analyses. Therefore, there were no implications to the health and safe of the public. Conditions Prior To Event Unit 1 Mode 5 at 0% power Unit 2 Mode 5 at 0% power

Description Of The Event

The Cook units are pressurized water reactors with ice condenser containments. The ice condenser containment requires that the steam and air flowing from the lower containment compartment in the event of an accident be routed to the upper compartment via the ice bed. To accomplish this, a structural barrier, called the divider barrier, separates the lower and upper containment compartments. The divider barrier includes the walls of the ice compartment, the upper deck, the compartments enclosing the upper portion of the steam generators and pressurizer, the gate separating the reactor cavity from the refueling canal, and portions of the walls of the refueling canal.

The design basis limits bypass flow around the ice bed to no more than 5 square feet (ft2). The installed bypass through the refueling cavity drains is equivalent to 2.2 ft2. As a result of

recent inspection efforts, it was determined that the 5 ft2 limit was potentially exceeded in the past as a result of multiple bypass conditions in addition to the installed bypass. The cumulative effect for the known bypass flow paths had been calculated to be 5.24 ft2. Since it could not be determined how long most of the identified conditions had existed, the bypass flow was conservatively assumed to have concurrently existed.

The degraded condition identified March 19, 1998, which was initially believed to increase the bypass flow above the design basis limit, was an area of gray duct tape on the bay 24 end wall. The duct tape appeared to be covering gaps in the sheet metal around conduits penetrating the ice condenser end wall. The gap in the sheet metal was estimated to be 1 ft2 with six separate two inch conduits penetrating the opening. The end wall of the ice condenser in the lower plenum area is a reinforced concrete wall with embedded pipe sleeves for glycol piping penetration and direct embedded conduit penetrations. After further physical examination of the area behind the sheet metal, it was determined that although a 1 ft2 existed in the sheet metal lagging and the insulation had been patched with gray duct tape, no gaps or openings in the wall were discovered. Based upon the physical configuration of the end wall in the area of the conduits, a 1 ft2 bypass path was determined not to exist. Utilizing a nominal two inch diameter and neglecting the cable in the conduits, the maximum potential flow path through the six conduits would be 0.13 ft2.

The revised cumulative known divider barrier bypass flow path was therefore 4.27 ft2. Although the revised bypass flowpath was determined to be below the design limit of 5 ft2, it was decided that, based on the number of degraded conditions which had been identified which resulted in bypass flow paths, the potential existed that unidentified bypass would result in a cumulative total of greater than 5 ft2. It was considered significant that the total bypass area had approached the design basis limit, therefore, this event was originally reported as a voluntarily LER.

On April 22, 1999, a condition was identified which did increase the bypass flow area above the 5 ft2 limit. This condition, an inadequate divider barrier seal (DBS) design and installation at the end walls of the ice condenser, does not provide a pressure tight boundary.

This represents an additional ice condenser bypass area of approximately 30.78 ft2. When combined with the historical cumulative bypass area, this represents atotal bypass area of approximately 35.05 ft2. The current known bypasses total approximately 34.98 ft2 , which accounts for repairs made after the original LER submittal. As described in the UFSAR, the divider

barrier seal is a flexible barrier located between the bottom of the ice condenser compartment and the containment cylinder wall to prevent the flow of steam and air from bypassing the ice condenser. The seal does not function as the pressure boundary by itself but is backed up by a steel plate with which it is in contact. The seal assembly is designed to withstand a peak pressure of 24 psi.
The DBS at the ice condenser end walls is installed as a ventilation barrier and not as a pressure retaining seal. It is postulated that this resulted from the original ice condenser design in which the ice baskets on the containment wall side extended all the way to the floor (58 ft). This original design was intended to ensure that any steam that entered the ice condenser would travel through the ice columns prior to entering upper containment, eliminating the need to have a pressure retaining seal on the end walls. With the current ice condenser design, the bottom of the ice baskets is 10 ft above the bottom of the lower plenum floor, When an event occurs, the air and steam enter the ice condenser lower plenum and can pressurize the area up to 12 psi, exposing the DBS seal at the end walls to that same pressure. Due to the current design of the seal, it is conservatively assumed that the seal will fail and allow the steam to bypass the ice baskets and enter into upper containment directly.

Cause Of The Event
The individual bypass conditions reported in the original LER were attributed to unauthorized modifications. The unauthorized modifications created bypass paths via material substitutions, original construction discrepancies, inadequate service life, and unsealing of spare penetrations during the performance of work activities. Based on the individual deficiencies, it was concluded that the cause of the pattern of degraded conditions was a lack of understanding of the design basis of containment as a system, in combination with a lack of documented configuration and inadequate implementation of the design change control process.
The apparent cause of the newly discovered ice condenser bypass is that the pressure seal required by a revised Westinghouse design was not incorporated into the AEP design. The reason for this discrepancy is unknown. According to the original Westinghouse ice condenser design, the ice baskets on the containment wall side started at the level of the ice condenser bottom slab and extended upward 58 feet. This design was to ensure that all steam entering the ice condenser would travel through the ice baskets before entering upper containment. With this design, only a ventilation barrier was needed to seal the end walls. Later, Westinghouse implemented a new design which located the bottoms of all ice baskets 10 ft above the ice condenser bottom slab. This is the

basket design that was installed at Cook Nuclear Plant. However, when the later design was introduced, the ventilation barrier was not upgraded to a include a pressure seal capable of withstanding 24 psi.

Analysis of the Event

This condition was determined to be reportable on March 19,1998, in accordance with 10CFR50.72(b)(2)(i), as a degraded condition discovered while the unit is shutdown that, if found while the reactor was operating, would have resulted in the plant being in an unanalyzed condition, and an ENS notification was made at 1422 hours EST. Although the investigation later revealed that the known cumulative bypass did not exceed the design limit of 5 ft2, the original LER was voluntarily submitted in accordance with 10CFR50.73(a)(2)(ii) as an event or condition outside the design basis of the plant. An additional ice condenser bypass condition involving the DBS identified on April 22, 1999 was also determined to be reportable pursuant to the requirements of 10 CFR50.73(a)(2)(ii). The DBS ice condenser bypass condition is applicable to both units. For Unit 1, refer to LER supplement 316/98-037-01.

The known bypass flow paths summarized below represent the condition as reported on March 20, 1998:

Open Area in ft2 Refueling Cavity Drains 2.2
Ice Condenser Air Handling Unit line 0.005 2-CPS-209, 2-CPS-210, 2-CPS-244 0.1
Conduit Penetration in #22 Steam Generator doghouse 0.087
Conduit Penetrations Using RTV Sealant 0.349
Divider Barrier Hatches 1.4
Ice Condenser End Wall Penetrations 0.13
TOTAL 4.271

The known bypass flow paths summarized below represent the current condition:

Open Area in ft2
Refueling Cavity Drains 2.2
Backdraft Damper of Air Return Lines 0.36
Ice Condenser Air Handling Unit drain line 0.005
2-CPS-209, 2-CPS-210, 2-CPS-244 0.0 (repaired)
Conduit Penetration in #22 Steam Generator doghouse 0.0 (repaired)
Conduit Penetrations Using RTV Sealant 0.0 (repaired)
Divider Barrier Hatches 1.4
Ice Condenser End Wall Penetrations 0.13
Pressurizer Enclosure Flange Opening 0.005

CPS-256 Rust Hole 0.005

CEQ Stairwell and Vent Well Drain Lines 0.1
Divider Barrier Seal 30.78
TOTAL 34.98

The cumulative bypass has been evaluated, and it has been concluded that the safety significance of this condition is negligible. Therefore, there were no implications to the health and safety of the public. Updated Final Safety Analysis Report (UFSAR) Chapter 5, Section 5.2.2.4 states that the design basis bypass area is 5 ft2. UFSAR Chapter 14.0 describes the accident analyses for different size pipe breaks and the allowable ice condenser bypass flow for each case. Analysis results indicate a value of 35 ft2 as the allowable deck leakage area for the entire spectrum of break sizes. The limiting case is an 8 inch break with one spray pump operating (2000 gpm at 80 degrees F). A second UFSAR analysis, using a more realistic method, states that with one spray pump the deck leakage could be 56 ft2 for an 8 inch break. This analysis takes credit for passive heat sinks and additional containment spray. Thus the identified historical value of bypass approximately 30.78 + 4.27 = 35.05 ft2) for Unit 2 is bounded by UFSAR analysis, but is outside of the ice condenser design basis value of 5 ft2. Therefore, since the plant was not in an unanalyzed condition, the ENS report made March 19, 1998, in accordance with 10CFR50.72(b)(2)(i), was determined to have been unnecessary.

CORRECTIVE ACTIONS

Numerous material condition walkdowns and assessments have been performed, which have increased the potential to identify bypass paths in the divider barrier. Significant degraded conditions resulting in divider barrier bypass are being corrected via corrective maintenance or design changes as they are identified. The Refueling Cavity Drains are permanent bypasses, which of course will remain open. The backdraft damper of the air return fans, ice condenser AHU line and the CEQ stairwell and vent well drain line bypasses are currently not scheduled for repair and represent an insignificant contribution to the cumulative ice condenser bypass. The DBS ice condenser bypass will be corrected via a design change prior to Mode 4. To prevent unauthorized or inadvertent design changes, 12 PMI 5040.DCP.001, Design Change Determination," has been developed and implemented. To enhance recognition of a design change, 12 PMI 2291.PLAN.001, "Work Control Planning Process," is being implemented. Additionally, the UFSAR validation project will enhance the quality of the design basis and configuration documentation. Procedure 12 EHP 6040 PER.154, "Containment Divider Barrier Walkdown," has been

developed to guide inspection of the divider barrier on a refueling outage frequency for possible bypass paths. This procedure includes provisions to ensure that the design basis allowable cumulative bypass is not exceeded, through correction and/or tracking of any identified bypass paths.

SIMILAR EVENTS: 315/98-037-00 316/98-004-00

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